Number and Quantity: The Real Number System (N-RN)

Extend the properties of exponents to rational exponents.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.N-RN.A.1. Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. *For example, we define $5^{1/3}$ to be the cube root of 5 because we want $(5^{1/3})^3 = 5^{(1/3)3}$ to hold, so $(5^{1/3})^3$ must equal 5.* Connections: *11-12.RST.4; 11-12.RST.9; 11-12.WHST.2d*	A II	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.3.* Construct viable arguments and critique the reasoning of others.	1.1 1.2 1.3 5.1 7.5 10.1 10.2 11.1 11.2 11.3	To create programs that accept a base, a numerator and a denominator of an exponent, and return a decimal value. Test data will need to be created by working the problem longhand to test the program.	**Question 1** What is the correct simplification of $25^{1/2}$? **Solution:** 5 **Question 2** What is the correct simplification of $4^{(1/3)3}$? **Solution:** 4
HS.N-RN.A.2. Rewrite expressions involving radicals and rational exponents using the properties of exponents.	A II	*HS.MP.7.* Look for and make use of structure.	1.1 1.2 1.3 5.1 7.5 10.1 10.2 11.1	To rewrite expressions so that they may be more easily coded into a computer programming language	Rewrite the following expression so that it may be placed into computer code. $X^{\frac{3}{2}}$ **Solution:** $\sqrt[2]{X^3}$

Number and Quantity: The Real Number System (N-RN) **Extend the properties of exponents to rational exponents.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
			11.2 11.3		

Number and Quantity: The Real Number System (N-RN) **Use properties of rational and irrational numbers.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.N-RN.B.3. Explain why the sum or product of two rational numbers are rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational. Connection: *9-10.WHST.1e*	A I	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.3.* Construct viable arguments and critique the reasoning of others.			

Number and Quantity: Quantities ★ (N-Q)

Reason qualitatively and use units to solve problems.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.N-Q.A.1. Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. Connections: *SCHS-S1C4-02*; *SSHS-S5C5-01*	A I ★	*HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically. *HS.MP.6.* Attend to precision.	1.1 1.2 1.3 7.5 10.1 10.2 11.1 11.2 11.3	To create programs which use the CPU timer and return usable time values. Test data will need to be created by working the problem longhand to test the program.	Convert 4,325,786 milliseconds into hours, minutes, and/or seconds. **Solution:** 4325.786 seconds
HS.N-Q.A.2. Define appropriate quantities for the purpose of descriptive modeling. Connection: *SSHS-S5C5-01*	A I A II ★	*HS.MP.4.* Model with mathematics. *HS.MP.6.* Attend to precision.	1.1 1.2 1.3 7.5 10.1 10.2 11.1 11.2 11.3	To understand the appropriate units to use when discussing such things as amount of memory, download speeds, etc.	Convert 45,623 kilobytes to megabytes. **Solution:** 44.5537
HS.N-Q.A.3. Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.	A I	*HS.MP.5.* Use appropriate tools strategically. *HS.MP.6.* Attend to precision.	1.1 1.2 1.3 7.5 10.1 10.2	To choose the data type with the correct degree of precision to store the data	Calculate the total cost of 18 gallons of gas priced at $4.2995 to the nearest cent. **Solution:** $77.39

Number and Quantity: Quantities ★ (N-Q) **Reason qualitatively and use units to solve problems.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
			11.1 11.2 11.3 14.2		

Number and Quantity: The Complex Number System (N-CN)

Perform arithmetic operations with complex numbers.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.N-CN.A.1. Know there is a complex number *i* such that $i^2 = -1$, and every complex number has the form $a + bi$ with *a* and *b* real.	A II	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.6.* Attend to precision.			
HS.N-CN.A.2. Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers. Connection: *11-12.RST.4*	A II	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.7.* Look for and make use of structure.	1.1 1.2 1.3 7.5 10.1 10.2 11.1 11.2 11.3 16.4 18.4 18.5 18.6	To create programs that will process complex numbers. Given the coefficients of the real and imaginary parts, the program will process the number correctly and return a complex number in the standard format. Test data will need to be created by working the problem longhand to test the program.	Simplify the following expression. Justify each step using the commutative, associative and distributive properties. (2-2i)(2+2i) **Solution:** 4-4i^2
HS.N-CN.A.3. Find the conjugate of a complex number; use conjugates to find moduli and	+	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.7.* Look for			

Number and Quantity: The Complex Number System (N-CN) **Perform arithmetic operations with complex numbers.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
quotients of complex numbers. Connection: *11-12.RST.3*		and make use of structure.			

Number and Quantity: The Complex Number System (N-CN)

Represent complex numbers and their operations on the complex plane.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.N-CN.B.4. Represent complex numbers on the complex plane in rectangular and polar form (including real and imaginary numbers), and explain why the rectangular and polar forms of a given complex number represent the same number. Connection: *11-12.RST.3*	+	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.7.* Look for and make use of structure.			
HS.N-CN.B.5. Represent addition, subtraction, multiplication, and conjugation of complex numbers geometrically on the complex plane; use properties of this representation for computation. *For example,* $(-1 + \sqrt{3}\, i)^3 = 8$ *because*	+	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.7.* Look for and make use of structure.			

Number and Quantity: The Complex Number System (N-CN) **Represent complex numbers and their operations on the complex plane.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
(-1 + √3 i) has modulus 2 and argument 120°.					
HS.N-CN.B.6. Calculate the distance between numbers in the complex plane as the modulus of the difference, and the midpoint of a segment as the average of the numbers at its endpoints. Connection: *11-12.RST.3*	+	*HS.MP.2.* Reason abstractly and quantitatively.			

Number and Quantity: The Complex Number System (N-CN)

Use complex numbers in polynomial identities and equations.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.N-CN.C.7. Solve quadratic equations with real coefficients that have complex solutions.	A II		1.1 1.2 1.3 7.5 10.1 10.2 11.1 11.2 11.3 12.1 12.2 12.3 12.4	To create programs that will process quadratic equations. Given the coefficients of the terms, the program will find the roots and determine if there are any real roots to be used in other functions. Test data will need to be created by working the problem longhand to test the program.	Find all solutions of $3x^2 + 5 = 2x$ and express them in the form $a + bi$. **Solution:** $\frac{1}{3} - \frac{\sqrt{14}}{3}i, \quad \frac{1}{3} + \frac{\sqrt{14}}{3}i$
HS.N-CN.C.8. Extend polynomial identities to the complex numbers. *For example, rewrite $x^2 + 4$ as $(x + 2i)(x – 2i)$.*	+	*HS.MP.7.* Look for and make use of structure.			
HS.N-CN.C.9. Know the Fundamental Theorem of Algebra; show that it is true for quadratic	+	*HS.MP.3.* Construct viable arguments and critique the reasoning of			

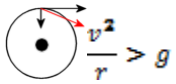
Number and Quantity: The Complex Number System (N-CN) **Use complex numbers in polynomial identities and equations.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
polynomials. Connection: *11-12.WHST.1c*		others. *HS.MP.7.* Look for and make use of structure.			

Number and Quantity: Vector and Matrix Quantities (N-VM)

Represent and model with vector quantities.

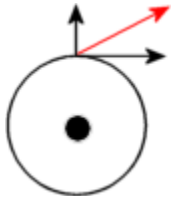
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.N-VM.A.1. Recognize vector quantities as having both magnitude and direction. Represent vector quantities by directed line segments, and use appropriate symbols for vectors and their magnitudes (e.g., *v*, |*v*|, ||*v*||, $\vec{v}$).	+	*HS.MP.4.* Model with mathematics.			
HS.N-VM.A.2. Find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point.	+	*HS.MP.2.* Reason abstractly and quantitatively.			
HS.N-VM.A.3. Solve problems involving velocity and other quantities that can be represented by vectors. Connections: *11-12.RST.9; SCHS-S5C2-01*; *SCHS-S5C2-02*;	+	*HS.MP.1.* Make sense of problems and persevere in solving them. *HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.4.* Model with	1.1 1.2 1.3 7.5 10.1 10.2 11.1 11.2 11.3 14.1	To create computer games using vectors to streamline the process. Test data will need to be created by working the problem longhand to test the	**Question 1** In a computer game a spaceship must achieve orbit around a planet. The spaceship is traveling at 10 kilometers/sec tangent to the planet at a distance of 50 kilometers. The acceleration of gravity is 9.3 meters/sec^2 directed straight toward the center of the planet. Calculate the vector sum of the gravity vector plus the velocity vector of the ship to achieve the resulting vector and then indicate if orbit around the planet has been obtained. **Solution:**

Number and Quantity: Vector and Matrix Quantities (N-VM)
Represent and model with vector quantities.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
SCHS-S5C2-06; 11-12.WHST.2d		mathematics. *HS.MP.5.* Use appropriate tools strategically. *HS.MP.6.* Attend to precision.	14.2 15.5	program.	 **Orbit has not been achieved.** **Question 2** If orbit has not been established, what changes would one need to make in the spaceship's approach to achieve orbit? **Solution:** Decrease velocity.

Number and Quantity: Vector and Matrix Quantities (N-VM)

Perform operations on vectors.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.N-VM.B.4. Add and subtract vectors.	+	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically.	1.1 1.2 1.3 7.5 10.1 10.2 11.1 11.2 11.3 14.1 14.2 15.5	To create computer games using vectors to streamline the process. Test data will need to be created by working the problem longhand to test the program.	A spaceship is flying across a solar system tangent to the star at an average speed of 17,000 miles per hour. There is a cross solar wind from the star at 1000 miles per hour. What is the magnitude and direction of the resultant? **Solution:**  **Magnitude 17029, angle 3.368 degrees above the tangent**
a. Add vectors end-to-end, component-wise, and by the parallelogram rule. Understand that the magnitude of a sum of two vectors is typically not the sum of the magnitudes.	+				
b. Given two vectors in magnitude and direction form, determine the magnitude and	+				

Number and Quantity: Vector and Matrix Quantities (N-VM)

Perform operations on vectors.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
direction of their sum.					
HS.N-VM.B.5. Multiply a vector by a scalar.	+	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically.	1.1 1.2 1.3 7.5 10.1 10.2 11.1 11.2 11.3 14.1 14.2 15.5	To create computer games using vectors to streamline the process. Test data will need to be created by working the problem longhand to test the program.	**Question 1** If a spaceship traveling at a vector of $\langle 3, 4 \rangle$ triples in speed, what is the resulting vector? **Solution:** <9,12> **Question 2** What value should the scalar be to reverse the direction of the ship? **Solution:** -1
a. Represent scalar multiplication graphically by scaling vectors and possibly reversing their direction; perform scalar multiplication component-wise, e.g., as $c(v_x, v_y) =$	+				

Number and Quantity: Vector and Matrix Quantities (N-VM) **Perform operations on vectors.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
(cv_x, cv_y).					
b. Compute the magnitude of a scalar multiple cv using $\|\|cv\|\| = \|c\|v$. Compute the direction of $c\mathbf{v}$ knowing that when $\|c\|v \neq 0$, the direction of cv is either along v (for $c > 0$) or against v (for $c < 0$). Connection: *ETHS-S6C1-03*	+				

Number and Quantity: Vector and Matrix Quantities (N-VM)

Perform operations on matrices and use matrices in applications.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.N-VM.C.6. Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network. Connections: *9-10.RST.7*; *9-10.WHST.2f*; *11-12.RST.9*; *11-12.WHST.2e*; *ETHS-S6C2-03*	+	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically.	1.1 1.2 1.3 7.5 10.1 10.2 11.1 11.2 11.3 15.1 15.2 15.3 15.4 15.5 15.6	To create programs using arrays to hold and manipulate data. Test data will need to be created by working the problem longhand to test the program.	Student 1 got scores of 91, 89, 78 and student 2 got scores of 87, 77, 92. Create a grade matrix that displays this data. **Solution:** $\begin{bmatrix} 91 & 89 & 78 \\ 87 & 77 & 92 \end{bmatrix}$
HS.N-VM.C.7. Multiply matrices by scalars to produce new matrices, e.g., as when all of the payoffs in a game are doubled. Connections: *9-10.RST.3*; *ETHS-S6C2-03*	+	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically.	1.1 1.2 1.3 7.5 10.1 10.2 11.1 11.2 11.3 15.1 15.2 15.3 15.4 15.6	To create programs using arrays to hold and manipulate data. Test data will need to be created by working the problem longhand to test the program.	Student 1 got scores of 94, 88, 78 and student 2 got scores of 86, 76, and 92. If a teacher weights every student's score in every assignment by a factor of 1.5, what would the resulting matrix contain? **Solution:** $\begin{bmatrix} 141 & 132 & 117 \\ 129 & 114 & 138 \end{bmatrix}$
HS.N-VM.C.8. Add, subtract, and	+	*HS.MP.2.* Reason abstractly and	1.1 1.2	To create programs using	**Question 1**

Number and Quantity: Vector and Matrix Quantities (N-VM)

Perform operations on matrices and use matrices in applications.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
multiply matrices of appropriate dimensions. Connections: *9-10.RST.3*; *ETHS-S6C2-03*		quantitatively. *HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically.	1.3 7.5 10.1 10.2 11.1 11.2 11.3 13.1 13.2 13.3 13.4 15.1 15.2 15.3 15.4 15.6	arrays to hold and manipulate data. Test data will need to be created by working the problem longhand to test the program.	Find 3*A* + *B* - C given Matrices *A*, *B,* and *C* below. Matrix *A*: $\begin{bmatrix} 5 & 30 & 10 \\ 21 & -5 & 0 \\ 9 & 15 & 4 \end{bmatrix}$ Matrix *B*: $\begin{bmatrix} 43 & 10 & 33 \\ -2 & -16 & 2 \\ 44 & 8 & -5 \end{bmatrix}$ Matrix *C*: $\begin{bmatrix} 7 & -3 & -1 \\ 12 & 14 & 88 \\ 18 & 52 & 44 \end{bmatrix}$ **Solution:** $\begin{bmatrix} 51 & 103 & 64 \\ 49 & -45 & -86 \\ 53 & 1 & -37 \end{bmatrix}$ **Question 2** Find $B \bullet C$ given Matrices *A*, *B,* and *C* below. Matrix *A*: $\begin{bmatrix} 5 & 30 & 10 \\ 21 & -5 & 0 \\ 9 & 15 & 4 \end{bmatrix}$ Matrix *B*: $\begin{bmatrix} 43 & 10 & 33 \\ -2 & -16 & 2 \\ 44 & 8 & -5 \end{bmatrix}$ Matrix *C*: $\begin{bmatrix} 7 & -3 & -1 \\ 12 & 14 & 88 \\ 18 & 52 & 44 \end{bmatrix}$ **Solution:** $\begin{bmatrix} 1015 & 1727 & 2289 \\ -170 & -114 & -1318 \\ 314 & -280 & 440 \end{bmatrix}$

Number and Quantity: Vector and Matrix Quantities (N-VM)

Perform operations on matrices and use matrices in applications.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.N-VM.C.9. Understand that, unlike multiplication of numbers, matrix multiplication for square matrices is not a commutative operation, but still satisfies the associative and distributive properties. Connections: *ETHS-S6C2-03*; *9-10.WHST.1e*	+	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.6.* Attend to precision.	1.1 1.2 1.3 7.5 10.1 10.2 11.1 11.2 11.3 12.1 12.2 12.3 12.4 13.1 13.2 13.3 13.4 15.1 15.2 15.3 15.4 15.6	To create programs using arrays to hold and manipulate data. Test data will need to be created by working the problem longhand to test the program.	Given $A=\begin{bmatrix}3 & -5\\ 2 & 7\end{bmatrix}$ *and* $B=\begin{bmatrix}-5 & 2\\ 7 & 3\end{bmatrix}$ *and* $C=\begin{bmatrix}9 & -4\\ 6 & 2\end{bmatrix}$, determine if the following statements are true: • $AB = BA$ • $(AB)C = A(BC)$ **Solution:** Both statements are true.
HS.N-VM.C.10. Understand that the zero and identity matrices play a role in matrix addition and multiplication similar to the role of	+	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.6.* Attend to precision.			

Number and Quantity: Vector and Matrix Quantities (N-VM) **Perform operations on matrices and use matrices in applications.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
0 and 1 in the real numbers. The determinant of a square matrix is nonzero if and only if the matrix has a multiplicative inverse.					
HS.N-VM.C.11. Multiply a vector (regarded as a matrix with one column) by a matrix of suitable dimensions to produce another vector. Work with matrices as transformations of vectors. Connections: *ETHS-S6C1-03*; *11-12.WHST.1a*	+	*HS.MP.4*. Model with mathematics. *HS.MP.5.* Use appropriate tools strategically.			
HS.N-VM.C.12. Work with 2×2 matrices as transformations of the plane, and interpret the absolute value of the determinant in	+	*HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically.			

Number and Quantity: Vector and Matrix Quantities (N-VM) **Perform operations on matrices and use matrices in applications.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
terms of area. Connection: *ETHS-S6C1-03*					

Algebra: Seeing Structure in Expressions (A-SSE)

Interpret the structure of expressions.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.A-SSE.A.1. Interpret expressions that represent a quantity in terms of its context.	A I ★	*HS.MP.1.* Make sense of problems and persevere in solving them. *HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.4.* Model with mathematics. *HS.MP.7.* Look for and make use of structure.			
a. Interpret parts of an expression, such as terms, factors, and coefficients. Connection: *9-10.RST.4*	A I ★				
b. Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret* $P(1+r)^n$ *as the product of P and a factor not depending on P.*	A I ★				
HS.A-SSE.A.2. Use the structure of an expression to identify ways to rewrite it. *For example, see* $x^4 - y^4$ *as* $(x^2)^2 -$		*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.7.* Look for and make use of structure.			

Algebra: Seeing Structure in Expressions (A-SSE) **Interpret the structure of expressions.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
$(y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 – y^2)(x^2 + y^2)$.					

Algebra: Seeing Structure in Expressions (A-SSE) **Write expressions in equivalent forms to solve problems.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.A-SSE.B.3. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. Connections: *9-10.WHST.1c*; *11-12.WHST.1c*	A I A II ★	*HS.MP.1.* Make sense of problems and persevere in solving them. *HS.MP.2.* Reason abstractly and quantitatively.			
a. Factor a quadratic expression to reveal the zeros of the function it defines.	A I ★	*HS.MP.4.* Model with mathematics.			
b. Complete the	A I	*HS.MP.7.* Look for			

Algebra: Seeing Structure in Expressions (A-SSE) **Write expressions in equivalent forms to solve problems.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
square in a quadratic expression to reveal the maximum or minimum value of the function it defines.	★	and make use of structure.			
c. Use the properties of exponents to transform expressions for exponential functions. *For example the expression* 1.15^t *can be rewritten as* $(1.15^{1/12})^{12t} \approx 1.012^{12t}$ *to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.*	A I A II ★				
HS.A-SSE.B.4. Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to	A II ★	*HS.MP.3.* Construct viable arguments and critique the reasoning of others. *HS.MP.4.* Model			

Algebra: Seeing Structure in Expressions (A-SSE) **Write expressions in equivalent forms to solve problems.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
solve problems. *For example, calculate mortgage payments.* Connection: *11-12.RST.4*		with mathematics. *HS.MP.7.* Look for and make use of structure.			

Algebra: Arithmetic with Polynomials and Rational Expressions (A-APR)

Perform arithmetic operations on polynomials.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.A-APR.A.1. Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials. Connection: *9-10.RST.4*	A I				

Algebra: Arithmetic with Polynomials and Rational Expressions (A-APR)

Understand the relationship between zeros and factors of polynomials.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.A-APR.B.2. Know and apply the Remainder Theorem: For a polynomial $p(x)$ and a number a, the remainder on	A II	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.3.* Construct viable arguments and critique the			

Algebra: Arithmetic with Polynomials and Rational Expressions (A-APR) **Understand the relationship between zeros and factors of polynomials.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
division by $x - a$ is $p(a)$, so $p(a) = 0$ if and only if $(x - a)$ is a factor of $p(x)$.		reasoning of others.			
HS.A-APR.B.3. Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.	A I A II	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically.			

Algebra: Arithmetic with Polynomials and Rational Expressions (A-APR)

Use polynomial identities to solve problems.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.A-APR.C.4. Prove polynomial identities and use them to describe numerical relationships. *For example, the polynomial identity* $(x^2+y^2)^2 = (x^2– y^2)^2 + (2xy)^2$ *can be used to generate Pythagorean triples.*	A II	*HS.MP.7.* Look for and make use of structure. *HS.MP.8.* Look for and express regularity in repeated reasoning.			
HS.A-APR.C.5. Know and apply the Binomial Theorem for the expansion of $(x + y)^n$ in powers of *x* and *y* for a positive integer *n*, where *x* and *y* are any numbers, with coefficients determined for example by Pascal's Triangle. (The Binomial Theorem can be proved by mathematical induction or by a combinatorial argument.)	+	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.3.* Construct viable arguments and critique the reasoning of others. *HS.MP.6.* Attend to precision. *HS.MP.7.* Look for and make use of structure.			

Algebra: Arithmetic with Polynomials and Rational Expressions (A-APR) **Rewrite rational expressions.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.A-APR.D.6. Rewrite simple rational expressions in different forms; write $a(x)/b(x)$ in the form $q(x) + r(x)/b(x)$, where $a(x)$, $b(x)$, $q(x)$, and $r(x)$ are polynomials with the degree of $r(x)$ less than the degree of $b(x)$, using inspection, long division, or, for the more complicated examples, a computer algebra system.	A II	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.7.* Look for and make use of structure.			
HS.A-APR.D.7. Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add,	+	*HS.MP.7.* Look for and make use of structure. *HS.MP.8.* Look for and express regularity in repeated reasoning.			

Algebra: Arithmetic with Polynomials and Rational Expressions (A-APR) **Rewrite rational expressions.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
subtract, multiply, and divide rational expressions.					

Algebra: Creating Equations ★ (A-CED)

Create equations that describe numbers or relationships.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.A-CED.A.1. Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear and quadratic functions, and simple rational and exponential functions.*	A I A II ★	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically.	1.1 1.2 1.3 7.5 10.1 10.2 11.1 11.2 11.3	To create programs that use linear and quadratic functions to obtain needed results from input data. Test data will need to be created by working the problem longhand to test the program.	Write an equation that converts 673 degrees Fahrenheit to Celsius. One equation is $F = \frac{9}{5} C + 32$ **Solution:** 356.111 $C = \frac{5}{9}(F - 32)$
HS.A-CED.A.2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.	A I ★	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically.	1.1 1.2 1.3 7.5 10.1 10.2 11.1 11.2 11.3	To create computer games using equations for placement and movement of objects on the screen. Test data will need to be created by working the problem longhand to test the program.	The path of a ship is given by the equation Y=3X-2, and another ship is Y=-X-6. Where do they intersect? **Solution:** (-1, -5)
HS.A-CED.A.3. Represent constraints by equations or inequalities, and by	A I ★	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.4.* Model with			

Algebra: Creating Equations ★ (A-CED) **Create equations that describe numbers or relationships.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.*		mathematics. *HS.MP.5.* Use appropriate tools strategically.			
HS.A-CED.A.4. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law V = IR to highlight resistance R.*	A I ★	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically. *HS.MP.7.* Look for and make use of structure.	1.1 1.2 1.3 7.5 10.1 10.2 11.1 11.2 11.3 14.1 14.2 14.3 14.4	To create programs that use formulas to obtain needed results from input data. Test data will need to be created by working the problem longhand to test the program. Sometimes the formulae must be manipulated to obtain the desired results.	Rearrange the following formula ($C = \pi d$) to calculate the diameter of a circle given its circumference. **Solution:** $d = C / \pi$

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.A-REI.A.1. Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.	A I A II	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.3.* Construct viable arguments and critique the reasoning of others. *HS.MP.7.* Look for and make use of structure.			
HS.A-REI.A.2. Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.	A II	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.3.* Construct viable arguments and critique the reasoning of others. HS*.MP.7.* Look for and make use of structure.	1.1 1.2 1.3 7.5 10.1 10.2 11.1 11.2 11.3 14.1 14.2 14.3 14.4	To create computer games using equations for placement and movement of objects on the screen. Test data will need to be created by working the problem longhand to test the program.	In a right triangle the hypotenuse is 25 and a leg is 20. What is the length of the remaining leg? **Solution:** 15

Algebra: Reasoning with Equations and Inequalities ★ (A-REI)

Solve equations and inequalities in one variable.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.A-REI.B.3. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.	A I	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.7.* Look for and make use of structure. *HS.MP.8.* Look for and express regularity in repeated reasoning.	1.1 1.2 1.3 7.5 10.1 10.2 11.1 11.2 11.3 14.1 14.2 14.3 14.4	To create programs using equations to obtain results from input data. Test data will need to be created by working the problem longhand to test the program. Equations will need to be manipulated to obtain the desired result.	If L = 2W, what does P equal? **Solution:** P = 6W
HS.A-REI.B.4. Solve quadratic equations in one variable.	A I A II	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.7.* Look for and make use of structure. *HS.MP.8.* Look for and express regularity in repeated reasoning.			
a. Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x - p)^2 = q$ that has the same solutions. Derive the quadratic formula from this	A I				

Algebra: Reasoning with Equations and Inequalities ★ (A-REI) **Solve equations and inequalities in one variable.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
form.					
b. Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b.	A I A II				

Algebra: Reasoning with Equations and Inequalities ★ (A-REI) **Solve systems of equations.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.A-REI.C.5. Prove that, given a system of two equations in two variables,	*A I*	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.3.*			

Algebra: Reasoning with Equations and Inequalities ★ (A-REI) **Solve systems of equations.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.		Construct viable arguments and critique the reasoning of others.			
HS.A-REI.C.6. Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. Connection: *ETHS-S6C2-03*	A I A II	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically. *HS.MP.6.* Attend to precision. *HS.MP.7.* Look for and make use of structure. *HS.MP.8.* Look for and express regularity in repeated reasoning.	1.1 1.2 1.3 7.5 10.1 10.2 11.1 11.2 11.3 14.1 14.2 14.3 14.4	To create computer games using systems of equations for placement, interaction, and movement of objects on the screen. Test data will need to be created by working the problem longhand to test the program.	One ship fires a missile along the path Y = 3X – 2, and the other ship is traveling along the path Y = –X – 6. Where does the missile hit the other ship? **Solution:** (-1, -5)
HS.A-REI.C.7. Solve a simple system consisting of a linear	A II	*HS.MP.2.* Reason abstractly and			

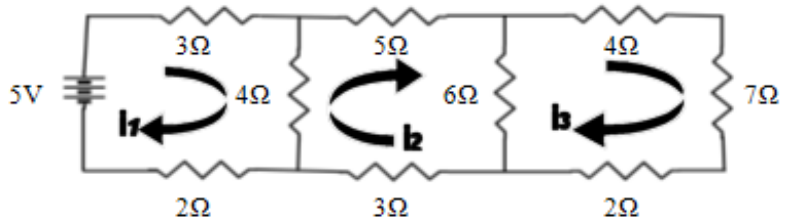
Algebra: Reasoning with Equations and Inequalities ★ (A-REI)

Solve systems of equations.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
equation and a quadratic equation in two variables algebraically and graphically. *For example, find the points of intersection between the line* $y = -3x$ *and the circle* $x^2 + y^2 = 3$.		quantitatively. *HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically. *HS.MP.6.* Attend to precision. *HS.MP.7.* Look for and make use of structure. *HS.MP.8.* Look for and express regularity in repeated reasoning.			
HS.A-REI.C.8. Represent a system of linear equations as a single matrix equation in a vector variable.	+		1.1 1.2 1.3 7.5 10.1 10.2 11.1 11.2 11.3 13.4 15.1 15.2	To create programs which engineers might use. Test data will need to be created by working the problem longhand to test the program.	Using Kirchhoff's Laws, solve a three loop circuit for all internal currents using determinants. The following matrix is generated from the values in a circuit. $\begin{bmatrix} 9 & -4 & 0 \\ -4 & 18 & 6 \\ 0 & -6 & 20 \end{bmatrix}$ The following solution matrix is also obtained. $\begin{bmatrix} -5 \\ 0 \\ 0 \end{bmatrix}$

Algebra: Reasoning with Equations and Inequalities ★ (A-REI)

Solve systems of equations.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
			15.3 15.4 15.6		 **Solution:** i_1=-0.61, i_2=-0.123, i_3=0.037
HS.A-REI.C.9. Find the inverse of a matrix if it exists, and use it to solve systems of linear equations (using technology for matrices of dimension 3 × 3 or greater). Connection: *ETHS-S6C2-03*	+	*HS.MP.5.* Use appropriate tools strategically. *HS.MP.6.* Attend to precision. *HS.MP.7.* Look for and make use of structure.			

Algebra: Reasoning with Equations and Inequalities ★ (A-REI)

Represent and solve equations and inequalities graphically.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***

Algebra: Reasoning with Equations and Inequalities ★ (A-REI) **Solve systems of equations.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.A-REI.D.10. Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).	A I	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.4.* Model with mathematics.			
HS.A-REI.D.11. Explain why the *x*-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are	A I A II ★	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically. *HS.MP.6.* Attend to precision.			

Algebra: Reasoning with Equations and Inequalities ★ (A-REI) **Solve systems of equations.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
linear, polynomial, rational, absolute value, exponential, and logarithmic functions. Connection: *ETHS-S6C2-03*					
HS.A-REI.D.12. Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.	A I	*HS.MP.4.* Model with mathematics. HS.MP.5. Use appropriate tools strategically.			

Functions: Interpreting Functions (F-IF)

Understand the concept of a function and use of function notation.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.F-IF.A.1. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If *f* is a function and *x* is an element of its domain, then *f*(*x*) denotes the output of *f* corresponding to the input *x*. The graph of *f* is the graph of the equation *y* = *f*(*x*).	A I	*HS.MP.2.* Reason abstractly and quantitatively.			
HS.F-IF.A.2. Use function notations, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context. Connection: *9-10.RST.4*	A I	*HS.MP.2.* Reason abstractly and quantitatively.	1.1 1.2 1.3 7.4 7.5 9.3 10.1 10.2 11.1 11.2 11.3	To create functions which return values. Test data will need to be created by working the problem longhand to test the program.	If $f(x) = x^2 + 7x - 2$, find $f(3)$. **Solution:** 28

Functions: Interpreting Functions (F-IF)

Understand the concept of a function and use of function notation.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.F-IF.A.3. Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. *For example, the Fibonacci sequence is defined recursively by f(0) = f(1) = 1, f(n+1) = f(n) + f(n-1) for n ≥ 1.*	A I A II	*HS.MP.8.* Look for and express regularity in repeated reasoning.	1.1 1.2 1.3 7.5 10.1 10.2 11.1 11.2 11.3 12.1 12.2 12.3 13.1	To create functions which call themselves one or more times before they return values. Test data will need to be created by working the problem longhand to test the program.	Define the solution of 5! by using n! = n times (n-1)! recursively. **Solution:** 120

Functions: Interpreting Functions (F-IF)

Interpret functions that arise in applications in terms of context.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.F-IF.B.4. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs	A I A II ★	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools	1.1 1.2 1.3 7.5 10.1 10.2 11.1 11.2 11.3 14.1	To create programs that solve real world problems and might be used by engineers. Test data will need to be created by working the problem longhand	An object is launched at 20 meters per second from a 60 meter tall platform. The equation which governs the height of the object is $H(t) = -5t^2+20t+60$, where H(t) is in meters. Determine the time at which the object hits the ground. **Solution:** 6 seconds

Functions: Interpreting Functions (F-IF) **Interpret functions that arise in applications in terms of context.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.* Connections: *ETHS-S6C2.03*; *9-10.RST.7*; *11-12.RST.7*		strategically. *HS.MP.6.* Attend to precision.	16.5	to test the program.	
HS.F-IF.B.5. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n*	A I ★	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.4.* Model with mathematics. *HS.MP.6.* Attend to precision.	1.1 1.2 1.3 7.5 9.2 9.3 10.1 10.2 11.1 11.2 11.3 19.1 19.2	To create functions that return values and to understand the limits on those functions. Test data will need to be created by working the problem longhand to test the program.	What is the domain of the square root function? **Solution:** $[0, \infty)$

Functions: Interpreting Functions (F-IF) **Interpret functions that arise in applications in terms of context.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
engines in a factory, then the positive integers would be an appropriate domain for the function. Connection: *9-10.WHST.2f*					
HS.F-IF.B.6. Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. Connections: *ETHS-S1C2-01*; *9-10.RST.3*	A I A II ★	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.4*. Model with mathematics. *HS.MP.5.* Use appropriate tools strategically.			

Functions: Interpreting Functions (F-IF)

Analyze functions using different representation.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.F-IF.C.7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.	A I A II + ★	*HS.MP.5.* Use appropriate tools strategically. *HS.MP.6.* Attend to precision.			
a. Graph linear and quadratic functions and show intercepts, maxima, and minima. Connections: *ETHS-S6C1-03*; *ETHS-S6C2-03*	A I ★				
b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. Connections: *ETHS-S6C1-03*; *ETHS-S6C2-03*	A I ★				

Functions: Interpreting Functions (F-IF)

Analyze functions using different representation.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. Connections: *ETHS-S6C1-03*; *ETHS-S6C2-03* *Continued on next page*	A II ★				
d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior. Connections: *ETHS-S6C1-03*; *ETHS-S6C2-03*	+ ★				
e. Graph exponential and logarithmic functions,	A II ★				

Functions: Interpreting Functions (F-IF) **Analyze functions using different representation.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude. Connections: *ETHS-S6C1-03*; *ETHS-S6C2-03*					
HS.F-IF.C.8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. Connection: *11-12.RST.7*	A I A II	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.7.* Look for and make use of structure.			
a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and	A I				

Functions: Interpreting Functions (F-IF)
Analyze functions using different representation.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
symmetry of the graph, and interpret these in terms of a context. Connection: *11-12.RST.7*					
b. Use the properties of exponents to interpret expressions for exponential functions. *For example, identify percent rate of change in functions such as* $y = (1.02)^t$, $y = (0.97)^t$, $y = (1.01)^{12t}$, $y = (1.2)^{t/10}$, *and classify them as representing exponential growth or decay.* Connection: *11-12.RST.7*	A II				
HS.F-IF.C.9. Compare properties	A I A II	*HS.MP.6.* Attend to precision.			

Functions: Interpreting Functions (F-IF) **Analyze functions using different representation.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.* Connections: *ETHS-S6C1-03*; *ETHS-S6C2-03*; *9-10.RST.7*		*HS.MP.7.* Look for and make use of structure.			

Functions: Building Functions (F-BF)

Build a function that models a relationship between two quantities.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.F-BF.A.1. Write a function that describes a relationship between two quantities. Connections: *ETHS-S6C1-03*; *ETHS-S6C2-03*	A I A II + ★	*HS.MP.1.* Make sense of problems and persevere in solving them. *HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically. *HS.MP.6.* Attend to precision. *HS.MP.7.* Look for and make use of structure. *HS.MP.8.* Look for and express regularity in repeated reasoning.	1.1 1.2 1.3 7.5 10.1 10.2 11.1 11.2 11.3	To create functions which use other functions within their calling parameters. Test data will need to be created by working the problem longhand to test the program.	**Question 1** Find the volume of a sphere given that the pressure is 5 atmospheres and that the sphere contains 2 moles of gas at a temperature 28 degrees Fahrenheit, if $PV = nRT, R = 0.082,$ and $T_K = \frac{5}{9}(T_y - 241)$. **Solution:** -3.8813 **Question 2** The function that describes the relationship between the volume and temperature of a gas is: $V(t) = \frac{nrt}{P}$, and the function that describes the relationship between the temperature in Fahrenheit and temperature in Kelvin is: $t(f) = \frac{5}{9(f-241)}$. What is the composite function $V(t(f))$? **Solution:** $V(t(f)) = \frac{nr\left(\frac{5}{9}(f-241)\right)}{P}$
a. Determine an explicit expression, a recursive process, or steps for calculation	A I A II ★				

Functions: Building Functions (F-BF)

Build a function that models a relationship between two quantities.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
from a context. Connections: *ETHS-S6C1-03*; *ETHS-S6C2-03*; *9-10.RST.7*; *11-12.RST.7*					
b. Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.* Connections: *ETHS-S6C1-03*; *ETHS-S6C2-03* *Continued on next page*	A II ★				
c. Compose	+				

Functions: Building Functions (F-BF) **Build a function that models a relationship between two quantities.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
functions. *For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather balloon as a function of time.* Connections: *ETHS-S6C1-03*; *ETHS-S6C2-03*	★				
HS.F-BF.A.2. Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.	A II ★	*HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically. *HS.MP.8.* Look for and express regularity in repeated	1.1 1.2 1.3 7.5 10.1 10.2 11.1 11.2 11.3 13.1	To create functions that generate values recursively. Test data will need to be created by working the problem longhand to test the program.	Generate the first 8 terms given f(0) = 0, f(x) = (x-1) +1. **Solution:** 1, 2, 3, 4, 5, 6, 7, 8

Functions: Building Functions (F-BF) **Build a function that models a relationship between two quantities.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
		reasoning.			

Functions: Building Functions (F-BF)

Build new functions from existing functions.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.F-BF.B.3. Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k f(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. *Include recognizing even and odd functions from their graphs and algebraic expressions for them.* Connections: *ETHS-S6C2-03*; *11-12.WHST.2e*	A I A II	*HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically. *HS.MP.7.* Look for and make use of structure.			
HS.F-BF.B.4 Find inverse functions. Connection: *ETHS-S6C2-03*	A II +	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.4.* Model with			
a. Solve an equation of the	A II				

Functions: Building Functions (F-BF) **Build new functions from existing functions.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
form $f(x) = c$ for a simple function f that has an inverse and write an expression for the inverse. *For example, $f(x) = 2x^3$ or $f(x) = (x+1)/(x-1)$ for $x \neq 1$.*		mathematics. *HS.MP.5.* Use appropriate tools strategically. *HS.MP.7.* Look for and make use of structure.			
b. Verify by composition that one function is the inverse of another.	+				
c. Read values of an inverse function from a graph or a table, given that the function has an inverse.	+				
d. Produce an invertible function from a non-invertible function by restricting the domain.	+				
HS.F-BF.B.5. Understand the inverse relationship	+	*HS.MP.2.* Reason abstractly and			

Functions: Building Functions (F-BF) **Build new functions from existing functions.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents. Connection: *ETHS-S6C2-03*		quantitatively. *HS.MP.6.* Attend to precision. *HS.MP.7.* Look for and make use of structure.			

Functions: Linear, Quadratic, and Exponential Models ★ (F-LE) **Construct and compare linear, quadratic, and exponential models and solve problems.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.F-LE.A.1. Distinguish between situations that can be modeled with linear functions and with exponential functions. Connections: *ETHS-S6C2-03*; *SSHS-S5C5-03*	A I ★	*HS.MP.3.* Construct viable arguments and critique the reasoning of others. *HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically. *HS.MP.7.* Look for and make use of structure. *HS.MP.8.* Look for and express regularity in repeated reasoning.			
a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. Connection: *11-12.WHST.1a-1e*	A I ★				
b. Recognize situations in which one quantity	A I ★				

Functions: Linear, Quadratic, and Exponential Models ★ (F-LE) **Construct and compare linear, quadratic, and exponential models and solve problems.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
changes at a constant rate per unit interval relative to another. Connection: *11-12.RST.4*					
c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another. Connections: *ETHS-S6C1-03*; *ETHS-S6C2-03*; *11-12.RST.4*	A I ★				
HS.F-LE.A.2. Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output	A I A II ★	*HS.MP.4.* Model with mathematics. *HS.MP.8.* Look for and express regularity in repeated reasoning.			

Functions: Linear, Quadratic, and Exponential Models ★ (F-LE) **Construct and compare linear, quadratic, and exponential models and solve problems.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
pairs (include reading these from a table). Connections: *ETHS-S6C1-03*; *ETHS-S6C2-03*; *11-12.RST.4*; *SSHS-S5C5-03*					
HS.F-LE.A.3. Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.	A I ★	*HS.MP.2.* Reason abstractly and quantitatively.			
HS.F-LE.A.4. For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where *a*, *c*, and *d* are numbers and the base *b* is 2, 10, or *e*; evaluate the logarithm using	A II ★	*HS.MP.7.* Look for and make use of structure.			

Functions: Linear, Quadratic, and Exponential Models ★ (F-LE) **Construct and compare linear, quadratic, and exponential models and solve problems.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
technology. Connections: *ETHS-S6C1-03*; *ETHS-S6C2-03*; *11-12.RST.3*					

Functions: Linear, Quadratic, and Exponential Models ★ (F-LE)

Interpret expressions for functions in terms of the situation they model.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.F-LE.B.5. Interpret the parameters in a linear or exponential function in terms of a context. Connections: *ETHS-S6C1-03*; *ETHS-S6C2-03*;*SSHS-S5C5-03*; *11-12.WHST.2e*	A I A II ★	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.4.* Model with mathematics.			

Functions: Trigonometric Functions ★ (F-TF)

Extend the domain of trigonometric functions using the unit circle.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.F-TF.A.1. Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.	A II				
HS.F-TF.A.2. Explain how the unit circle in the coordinate plane enables the extension of	A II	*HS.MP.2.* Reason abstractly and quantitatively.			

Functions: Trigonometric Functions ★ (F-TF) **Extend the domain of trigonometric functions using the unit circle.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle. Connections: *ETHS-S1C2-01*; *11-12.WHST.2b*; *11-12.WHST.2e*					
HS.F-TF.A.3. Use special triangles to determine geometrically the values of sine, cosine, tangent for π/3, π/4 and π/6, and use the unit circle to express the values of sine, cosine, and tangent for π-*x*, π+*x*, and 2π-*x* in terms of their values for *x*, where *x* is any real number. Connection: *11-12.WHST.2b*	+	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.6.* Attend to precision. *HS.MP.7.* Look for and make use of structure.			

Functions: Trigonometric Functions ★ (F-TF) **Extend the domain of trigonometric functions using the unit circle.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.F-TF.A.4. Use the units circle to explain symmetry (odd and even) and periodicity of trigonometric functions. Connections: *ETHS-S1C2-01; 11-12.WHST.2c*	+	*HS.MP.3.* Construct viable arguments and critique the reasoning of others. *HS.MP.5.* Use appropriate tools strategically.			

Functions: Trigonometric Functions ★ (F-TF) **Model periodic phenomena with trigonometric functions.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.F-TF.B.5. Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline. Connection: *ETHS-S1C2-01*	A II ★	*HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically. *HS.MP.7.* Look for and make use of structure.			
HS.F-TF.B.6. Understand that restricting a	+				

Functions: Trigonometric Functions ★ (F-TF) **Model periodic phenomena with trigonometric functions.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed. Connections: *ETHS-S1C2-01*; *11-12.WHST.2e*					
HS.F-TF.B.7. Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context. Connections: *ETHS-S1C2-01; 11-12.WHST.1a*	+ ★	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.5.* Use appropriate tools strategically.			

Functions: Trigonometric Functions ★ (F-TF) **Prove and apply trigonometric identities.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.F-TF.C.8. Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to find sin(θ), cos(θ), or tan(θ) given sin(θ), cos(θ), or tan(θ) and the quadrant of the angle. Connection: *11-12.WHST.1a-1e*	A II	*HS.MP.3.* Construct viable arguments and critique the reasoning of others.			
HS.F-TF.C.9. Prove the addition and subtraction formulas for sine, cosine, and tangent and use them to solve problems. Connection: *11-12.WHST.1a-1e*	+	*HS.MP.3.* Construct viable arguments and critique the reasoning of others.			

Geometry: Congruence (G-CO)

Experiment with transformations in the plane.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.G-CO.A.1. Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc. Connection: *9-10.RST.4*	G	*HS.MP.6*. Attend to precision.	1.1 1.2 1.3 7.5 10.1 10.2 11.1 11.2 11.3 13.1 13.2 13.4 18.3	To create functions which generate graphical objects from the API, and to understand how the API functions connect to their mathematical definitions. Test data will need to be created by working the problem longhand to test the program.	**Project 1** Construct a circle using the definition of all points that are a distance of 3 centimeters from a set point (3, 4). $(x-3)^2 + (g-4)^2 = 3^2$. **Project 2** Use a repetition code block to draw a fence with parallel posts along a picture of a house.
HS.G-CO.A.2. Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance	G	*HS.MP.5.* Use appropriate tools strategically.	1.1 1.2 1.3 7.5 9.2 10.1 10.2 11.1 11.2 11.3	To use a graphics library and write mutator methods that transform the object by resizing the specific parts and maintain aspect ratios	**Project** Create a stickman figure that increases proportionally in size or shifts or translates so that the stickman appears to be moving toward the viewer.

Geometry: Congruence (G-CO) **Experiment with transformations in the plane.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
and angle to those that do not (e.g., translation versus horizontal stretch). Connection: *ETHS-S6C1-03*					
HS.G-CO.A.3. Given a rectangle, parallelogram, trapezoid, or regular polygons, describe the rotations and reflections that carry it onto itself. Connections: *ETHS-S6C1-03*; *9-10.WHST.2c*	G	*HS.MP.3* Construct viable arguments and critique the reasoning of others. *HS.MP.5.* Use appropriate tools strategically.	1.1 1.2 1.3 7.5 9.2 10.1 10.2 11.1 11.2 11.3 14.2 15.2	To write transform methods to mutate graphic objects on a Cartesian coordinate plane	**Project** Create software that shows the reflection of a graphic on the water that it stands on; i.e. draw programmatically a picture of a sailboat with a trapezoidal base and have the software draw the reflection underneath the boat.
HS.G-CO.A.4. Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments. Connections: *ETHS-S6C1-03*; *9-10.WHST.4*	G	*HS.MP.6.* Attend to precision. *HS.MP.7.* Look for and make use of structure.	1.1 1.2 1.3 7.2 7.5 8.2 10.1 10.2 11.1 11.2 11.3 12.1 13.3	To write transform methods to mutate graphic objects on a Cartesian coordinate plane	**Project** Students will use the graphics capability of a programming language to generate animation of a square rotating, (i.e. a block falling down a hill, a windmill with rectangular blades).

Geometry: Congruence (G-CO)

Experiment with transformations in the plane.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.G-CO.A.5. Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another. Connections: *ETHS-S6C1-03*; *9-10.WHST.3*	G	*HS.MP.3.* Construct viable arguments and critique the reasoning of others. *HS.MP.5.* Use appropriate tools strategically. *HS.MP.7.* Look for and make use of structure.	1.1 1.2 1.3 7.5 10.1 10.2 11.1 11.2 11.3 18.3	To create functions that will rotate, reflect, and/or translate a graphical object. Test data will need to be created by working the problem longhand to test the program.	**Project** Take one shape and transform it into another shape by using rotation, reflection, and/or translation. **Question** A trapezoid with vertices at (0, 0), (3, 4), (7, 4), and (10, 0) is rotated counter-clockwise around the origin 90 degrees and is moved up 10 and to the right 5. What are the new coordinates of the vertices? **Solution:** (5, 10), (1, 13), (1,17), (5,20)

Geometry: Congruence (G-CO)

Understand congruence in terms of rigid motions.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.G-CO.B.6. Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent. Connections: *ETHS-S1C2-01*; *9-10.WHST.1e*	G	*HS.MP.3*. Construct viable arguments and critique the reasoning of others. *HS.MP.5.* Use appropriate tools strategically. *HS.MP.7*. Look for and make use of structure.			
HS.G-CO.B.7. Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.	G	*HS.MP.3.* Construct viable arguments and critique the reasoning of others.	1.1 1.2 1.3 7.5 10.1 10.2 11.1 11.2 11.3 18.3 18.7 18.8 12.1	To define congruency in programming code by comparing side lengths and corresponding angles	To prove that Triangle 1 is congruent to Triangle 2, using only rigid transformations, what transformation would one use to map Triangle 1 onto Triangle 2? Triangle 1: (2,-1) (3,4) (5,-2) Triangle 2: (6,-3) (7,2) (9,-4) **Solution:** A translation of 4 right and 2 down

Geometry: Congruence (G-CO) **Understand congruence in terms of rigid motions.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
Connection: *9-10.WHST.1e*			12.2 12.3 12.4		
HS.G-CO.B.8. Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions. Connection: *9-10.WHST.1e*	G	*HS.MP.3.* Construct viable arguments and critique the reasoning of others.			

Geometry: Congruence (G-CO) **Prove geometric theorems.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.G-CO.C.9. Prove theorems about lines and angles. *Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior*	G	*HS.MP.3.* Construct viable arguments and critique the reasoning of others. *HS.MP.5.* Use appropriate tools			

Geometry: Congruence (G-CO) **Prove geometric theorems.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints. Connections: *ETHS-S1C2-01*; *9-10.WHST.1a-1e*		strategically.			
HS.G-CO.C.10. Prove theorems about triangles. *Theorems include: measures of interior angles of a triangle sum to 180°; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.*	G	*HS.MP.3.* Construct viable arguments and critique the reasoning of others. *HS.MP.5.* Use appropriate tools strategically.			

Geometry: Congruence (G-CO) **Prove geometric theorems.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
Connections: *ETHS-S1C2-01*; *9-10.WHST.1a-1e*					
HS.G-CO.C.11. Prove theorems about parallelograms. *Theorems include: opposite sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals.* Connection: *9-10.WHST.1a-1e*	G	*HS.MP.3.* Construct viable arguments and critique the reasoning of others. *HS.MP.5.* Use appropriate tools strategically.			

Geometry: Congruence (G-CO) **Make geometric constructions.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.G-CO.D.12. Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). *Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.* Connection: *ETHS-S6C1-03*	G	*HS.MP.5.* Use appropriate tools strategically. *HS.MP.6.* Attend to precision.			
HS.G-CO.D.13. Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.	G	*HS.MP.5.* Use appropriate tools strategically. *HS.MP.6.* Attend to precision.			

Geometry: Congruence (G-CO) **Make geometric constructions.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
Connection: *ETHS-S6C1-03*					

Geometry: Similarity, Right Triangles, and Trigonometry (G-SRT) **Understand similarity in terms of similarity transformations.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.G-SRT.A.1. Verify experimentally the properties of dilations given by a center and a scale factor: Connections: *ETHS-S1C2-01*; *9-10.WHST.1b*; *9-10.WHST.1e*	G	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.5*. Use appropriate tools strategically.			
a. Dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged.	G				
b. The dilation of a line segment is longer or shorter in the ratio given by the scale factor.	G				
HS.G-SRT.A.2. Given two figures, use the definition of similarity in terms of	G	*HS.MP.3*. Construct viable arguments and critique the			

Geometry: Similarity, Right Triangles, and Trigonometry (G-SRT) **Understand similarity in terms of similarity transformations.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides. Connections: *ETHS-S1C2-01*; *9-10.RST.4*; *9-10.WHST.1c*		reasoning of others. *HS.MP.5*. Use appropriate tools strategically. *HS.MP.7*. Look for and make use of structure.			
HS.G-SRT.A.3. Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar. Connections: *ETHS-S1C2-01*; *9-10.RST.7*	G	*HS.MP.3*. Construct viable arguments and critique the reasoning of others.			

Geometry: Similarity, Right Triangles, and Trigonometry (G-SRT)

Prove theorems involving similarity.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.G-SRT.B.4. Prove theorems about triangles. *Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity.* Connections: *ETHS-S1C2-01*; *9-10.WHST.1a-1e*	G	*HS.MP.3.* Construct viable arguments and critique the reasoning of others. *HS.MP.5*. Use appropriate tools strategically.			
HS.G-SRT.B.5. Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures. Connections: *ETHS-S1C2-01*; *9-10.WHST.1a-1e*	G	*HS.MP.3.* Construct viable arguments and critique the reasoning of others. HS.MP.5. Use appropriate tools strategically.			

Geometry: Similarity, Right Triangles, and Trigonometry (G-SRT)

Define trigonometric ratios and solve problems involving right triangles.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.G-SRT.C.6. Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles. Connection: *ETHS-S6C1-03*	G		1.1 1.2 1.3 7.5 10.1 10.2 11.1 11.2 11.3 16.5 18.3 18.5	To create computer games in which players may specify angle and distance of travel for placement and movement of objects on the screen. Test data will need to be created by working the problem longhand to test the program.	An object located at (8, 5) travels at an angle of 28 degrees above the horizontal for a distance of 27 units. Find the coordinates of the new location of this object using the trigonometric ratios. **Solution:** (23.840, 17.675)
HS.G-SRT.C.7. Explain and use the relationship between the sine and cosine of complementary angles. Connections: *ETHS-S1C2-01*; *ETHS-S6C1-03*; *9-10.WHST.1c*; *9-10.WHST.1e*	G				
HS.G-SRT.C.8. Use trigonometric ratios and the Pythagorean	G ★	*HS.MP.1.* Make sense of problems and persevere in	1.1 1.2 1.3	To create software to determine the	A plane is on approach to the airport and is currently horizontally 1,000 feet away. Its current altitude is 50 feet. What angle of depression is needed to land the plane?

Geometry: Similarity, Right Triangles, and Trigonometry (G-SRT) **Define trigonometric ratios and solve problems involving right triangles.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
Theorem to solve right triangles in applied problems. Connections: *ETHS-S6C2-03*; *9-10.RST.7*		solving them. *HS.MP.4*. Model with mathematics. *HS.MP.5.* Use appropriate tools strategically.	7.5 10.1 10.2 11.1 11.2 11.3 12.1 12.2	angle of depression on approach to an airport runway given the horizontal distance from the runway and the altitude of the airplane. Use sine, cosine, and tangent relationships.	**Solution:** 2.86 degrees

Geometry: Circles (G-SRT) **Apply trigonometry to general triangles.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.G-SRT.D.9. Derive the formula $A = \frac{1}{2} ab \sin(C)$ for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side. Connection: *ETHS-S6C1-03*	+	*HS.MP.3.* Construct viable arguments and critique the reasoning of others. *HS.MP.7.* Look for and make use of structure.			

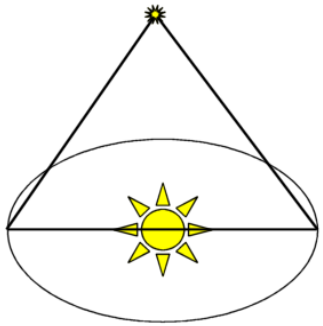
Geometry: Circles (G-SRT)

Apply trigonometry to general triangles.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.G-SRT.D.10. Prove the Laws of Sines and Cosines and use them to solve problems. Connections: *ETHS-S6C1-03*; *11-12.WHST.1a-1e*	+	*HS.MP.3.* Construct viable arguments and critique the reasoning of others. *HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically. *HS.MP.6.* Attend to precision. *HS.MP.7*. Look for and make use of structure. *HS.MP.8.* Look for and express regularity in repeated reasoning.			
HS.G-SRT.D.11. Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in	+	HS.MP.1. Make sense of problems and persevere in solving them. HS.MP.4. Model with mathematics.	1.1 1.2 1.3 7.5 10.1 10.2 11.1	To create computer games in which players can calculate the distance to an object knowing the angles to the	An astronomer takes the angle of a distant star with the plane of the sun to be 89.5 degrees. Exactly 6 months later he again takes the same measurement and finds it to be 89.8 degrees. Since the diameter of the earth's orbit is 186 million miles, what is the distance from the earth at each point to the star?

Geometry: Circles (G-SRT)

Apply trigonometry to general triangles.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
right and non-right triangles (e.g., surveying problems, resultant forces). Connections: *11-12.WHST.2c*; *11-12.WHST.2e*			11.2 11.3 16.5 18.3 18.5	object and distance between sighting points. Test data will need to be created by working the problem longhand to test the program.	 **Solution:** 150 and 152 billion miles
HS.G-SRT.D.11. Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces). Connections: *11-12.WHST.2c*; *11-12.WHST.2e*	+	HS.MP.1. Make sense of problems and persevere in solving them. HS.MP.4. Model with mathematics.			

Geometry: Circles (G-C) **Understand and apply theorems about circles.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.G-C.A.1. Prove that all circles are similar. Connections: *ETHS-S1C2-01*; *9-10.WHST.1a-1e*	G	*HS.MP.3.* Construct viable arguments and critique the reasoning of others. *HS.MP.5.* Use appropriate tools strategically.			
HS.G-C.A.2. Identify and describe relationships among inscribed angles, radii, and chords. *Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.* Connections: *9-10.WHST.1c;*	G	*HS.MP.3.* Construct viable arguments and critique the reasoning of others. *HS.MP.5.* Use appropriate tools strategically.			

Geometry: Circles (G-C)

Understand and apply theorems about circles.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
11-12.WHST.1c					
HS.G-C.A.3. Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.	G	*HS.MP.3.* Construct viable arguments and critique the reasoning of others. *HS.MP.5*. Use appropriate tools strategically.	1.1 1.2 1.3 7.5 10.1 10.2 11.1 11.2 11.3	To use a programming language to program a game to draw a circumscribed circle inside a triangle	**Project** Construct circumscribed circles of a triangle.
HS.G-C.A.4. Construct a tangent line from a point outside a given circle to the circle. Connection: *ETHS-S6C1-03*	+	*HS.MP.3.* Construct viable arguments and critique the reasoning of others. *HS.MP.5.* Use appropriate tools strategically.			

Geometry: Circles (G-C)

Find arc lengths and areas of sectors of circles.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.G-C.B.5. Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector. Connections: *ETHS-S1C2-01*; *11-12.RST.4*	G	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.3.* Construct viable arguments and critique the reasoning of others.	1.1 1.2 1.3 7.5 10.1 10.2 11.1 11.2 11.3	To create 2D side-scrolling games that show a car driving	**Project** Students draw lines that are tangent to the wheels on a vehicle that lies on the road.

Geometry: Expressing Geometric Properties with Equations (G-GPE) **Translate between the geometric description and the equation for a conic section.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.G-GPE.A.1. Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation. Connections: *ETHS-S1C2-01*; *11-12.RST.4*	G	*HS.MP.7.* Look for and make use of structure. HS.MP.8. Look for and express regularity in repeated reasoning.			
HS.G-GPE.A.2. Derive the equation of a parabola given a focus and directrix. Connections: *ETHS-S1C2-01*; *11-12.RST.4*	A II	*HS.MP.7.* Look for and make use of structure. HS.MP.8. Look for and express regularity in repeated reasoning.			
HS.G-GPE.A.3. Derive the equations of ellipses and hyperbolas given the foci, using the fact that the sum or difference of	+	*HS.MP.7.* Look for and make use of structure. HS.MP.8. Look for and express regularity in repeated			

Geometry: Expressing Geometric Properties with Equations (G-GPE) **Translate between the geometric description and the equation for a conic section.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
distances from the foci is constant. Connections: *ETHS-S1C2-01*; *11-12.RST.4*		reasoning.			

Geometry: Expressing Geometric Properties with Equations (G-GPE) **Use coordinates to prove simple geometric theorems algebraically.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.G-GPE.B.4. Use coordinates to prove simple geometric theorems algebraically. *For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point (1, √3) lies on the circle centered at the origin and containing the point (0, 2).* Connections: *ETHS-*	G	*HS.MP.3.* Construct viable arguments and critique the reasoning of others.			

Geometry: Expressing Geometric Properties with Equations (G-GPE) **Use coordinates to prove simple geometric theorems algebraically.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
S1C2-01; *9-10.WHST.1a-1e*; *11-12.WHST.1a-1e*					
HS.G-GPE.B.5. Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point). Connection: *9-10.WHST.1a-1e*	G	*HS.MP.3.* Construct viable arguments and critique the reasoning of others. *HS.MP.8.* Look for and express regularity in repeated reasoning.			
HS.G-GPE.B.6. Find the point on a directed line segment between two given points that partitions the segment in a given ratio. Connections: *ETHS-S1C2-01*; *9-10.RST.3*	G	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.8*. Look for and express regularity in repeated reasoning.	1.1 1.2 1.3 7.5 10.1 10.2 11.1 11.2 11.3	To use a programming language to find the midpoints of each side of a triangle. Students will draw a smaller triangle by drawing lines between those midpoints.	Given the line segment created by the points (-2, 4) & (4,-2), which points would be placed to create a 2:1 ratio? **Solution:** (0, 2)
HS.G-GPE.B.7. Use	G	*HS.MP.2.* Reason	1.1	To create	Given the coordinates of (0, 0), (5, 10), (10, 0), find the area that a figure

Geometry: Expressing Geometric Properties with Equations (G-GPE)

Use coordinates to prove simple geometric theorems algebraically.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula. Connections: *ETHS-S1C2-01*; *9-10.RST.3*; *11-12.RST.3*	★	abstractly and quantitatively. *HS.MP.5.* Use appropriate tools strategically. *HS.MP.6.* Attend to precision.	1.2 1.3 7.5 10.1 10.2 11.1 11.2 11.3 16.5	programs that solve real world problems by deriving the coordinates of the figure from screen coordinates. Test data will need to be created by working the problem longhand to test the program.	composed of line segments between the three points encloses. **Solution:** 50

Geometry: Geometric Measurement and Dimension (G-GMD) **Explain volume formulas and use them to solve problems.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.G-GMD.A.1. Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. *Use dissection arguments, Cavalieri's principle, and informal limit arguments.* Connections: *9-10.RST.4; 9-10.WHST.1c; 9-10.WHST.1e; 11-12.RST.4; 11-12.WHST.1c; 11-12.WHST.1e*	G	*HS.MP.3.* Construct viable arguments and critique the reasoning of others. *HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically.			
HS.G-GMD.A.2. Give an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures. Connections: *9-10.RST.4*;	+	*HS.MP.3.* Construct viable arguments and critique the reasoning of others. HS.MP.4. Model with mathematics.			

Geometry: Geometric Measurement and Dimension (G-GMD)

Explain volume formulas and use them to solve problems.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
9-10.WHST.1c; *9-10.WHST.1e*; *11-12.RST.4*; *11-12.WHST.1c*; *11-12.WHST.1e*		HS.MP.5. Use appropriate tools strategically.			
HS.G-GMD.A.3. Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems. Connection: *9-10.RST.4*	G ★	*HS.MP.1.* Make sense of problems and persevere in solving them. *HS.MP.2.* Reason abstractly and quantitatively.			

Geometry: Geometric Measurement and Dimension (G-GMD)

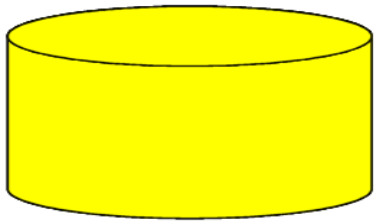
Visualize relationships between two-dimensional and three dimensional objects.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.G-GMD.B.4. Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.	G	*HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically.			

Geometry: Geometric Measurement and Dimension (G-GMD) **Visualize relationships between two-dimensional and three dimensional objects.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
Connection: *ETHS-S1C2-01*					

Geometry: Geometric Measurement and Dimension ★ (G-MG)

Apply geometric concepts in modeling situations.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.G-MG.A.1. Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder). Connections: *ETHS-S1C2-01*; *9-10.WHST.2c*	G ★	*HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically. *HS.MP.7.* Look for and make use of structure.			
HS.G-MG.A.2. Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). Connection: *ETHS-S1C2-01*	G ★	*HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically. *HS.MP.7.* Look for and make use of structure.	1.1 1.2 1.3 7.5 10.1 10.2 11.1 11.2 11.3 16.5	To create programs which solve real world 3D modeling problems by using the properties of real objects in unique situations. Test data will need to be created by working the problem longhand to test the program.	A cylindrical water craft, having the diameter of its base 6 feet and its height 4 feet, floats with its top edge 1 foot out of the water on earth where the water density is 64.2 pounds/cubic foot. When this same craft is placed in a fluid-filled lake on another planet it floats with its top edge 2 feet out of the liquid. Assuming all other factors are the same, what must the density of the liquid be on this other planet?  **Solution:** 96.3

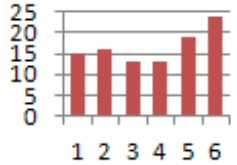
Geometry: Geometric Measurement and Dimension ★ (G-MG)

Apply geometric concepts in modeling situations.

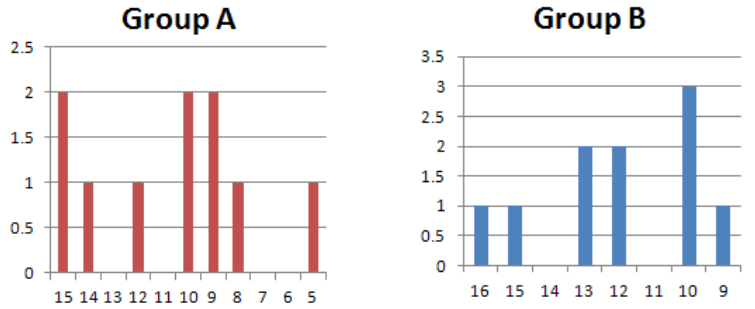
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.G-MG.A.3. Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios). Connection: *ETHS-S1C2-01*	G ★	*HS.MP.1.* Make sense of problems and persevere in solving them. *HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically.	1.1 1.2 1.3 7.5 10.1 10.2 11.1 11.2 11.3 16.5	To create programs which solve real world 3D modeling problems by using the properties of real objects in unique situations. Test data will need to be created by working the problem longhand to test the program.	Given 35 feet of fence and the need to enclose the maximum area, what geometric figure would enclose the most area? **Solution:** Circle

Statistics and Probability: Interpreting Categorical and Quantitative Data★ (S-ID)

Summarize, represent, and interpret data on a single count or measurement variable.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.S-ID.A.1. Represent data with plots on the real number line (dot plots, histograms, and box plots). Connections: *SCHS-S1C1-04*; *SCHS-S1C2-03*; *SCHS-S1C2-05*; *SCHS-S1C4-02*; *SCHS-S2C1-04*; *ETHS-S6C2-03*; *SSHS-S1C1-04*; *9-10.RST.7*	A I ★	*HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically.	1.1 1.2 1.3 7.5 9.2 10.1 10.2 11.1 11.2 11.3 12.1 12.2	To develop algorithms to compute the mean, median, and mode of data	A die from a game is rolled 100 times. Display the following data in a histogram form. 1 15 2 16 3 13 4 13 5 19 6 24 **Solution:** 
HS.S-ID.A.2. Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets. Connections: *SCHS-S1C3-06*;	A I ★	*HS.MP.2*. Reason abstractly and quantitatively. *HS.MP.3*. Construct viable arguments and critique the reasoning of others. *HS.MP.4.* Model with mathematics. HS.MP.5. Use	1.1 1.2 1.3 7.2 7.5 10.1 10.2 11.1 11.2 11.3 12.1 12.2	Students develop algorithms to compute the mean, median, and mode of data.	**Question 1** Using the following data, what are the mean, median, mode, and standard deviation of those students? Student one scored 100. Student two scored 98. Student three scored 75. Student four scored 80. Student five scored 96. **Solution:** Mean=89.8 Median=96 Mode=N/A Standard Deviation: 10.24

Statistics and Probability: Interpreting Categorical and Quantitative Data★ (S-ID)
Summarize, represent, and interpret data on a single count or measurement variable.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
ETHS-S6C2-03; *SSHS-S1C1-01*		appropriate tools strategically. *HS.MP.7.* Look for and make use of structure.			**Question 2** Using the following scores, what can be said about the two groups? Group A: 15 15 14 12 10 10 9 9 8 5 — Mean 10.7, Median 10, Range 10, SD 3.267687 Group B: 16 15 13 13 12 12 10 10 10 9 — Mean 12, Median 12, Range 7, SD 2.309401  **Solution:** As a group, B has higher and more closely packed scores.
HS.S-ID.A.3. Interpret differences in shape, center, and spread in the context of the data sets, accounting for	A I ★	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.3.* Construct viable arguments and			

Statistics and Probability: Interpreting Categorical and Quantitative Data★ (S-ID) **Summarize, represent, and interpret data on a single count or measurement variable.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
possible effects of extreme data points (outliers). Connections: *SSHS-S1C1-01*; *ETHS-S6C2-03*; *9-10.WHST.1a*		critique the reasoning of others. *HS.MP.4*. Model with mathematics. *HS.MP.5.* Use appropriate tools strategically. *HS.MP.7.* Look for and make use of structure.			
HS.S-ID.A.4. Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.	A II ★	*HS.MP.1.* Make sense of problems and persevere in solving them. *HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.3.* Construct viable arguments and critique the reasoning of others. *HS.MP.4.* Model with mathematics.			

Statistics and Probability: Interpreting Categorical and Quantitative Data★ (S-ID) **Summarize, represent, and interpret data on a single count or measurement variable.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
Connections: *ETHS-S1C2-01*; *ETHS-S6C2-03*; *11-12.RST.7*; *11-12.RST.8*; *11-12.WRT.1b*		*HS.MP.5.* Use appropriate tools strategically. *HS.MP.6.* Attend to precision. *HS.MP.7.* Look for and make use of structure. *HS.MP.8.* Look for and express regularity in repeated reasoning.			

Statistics and Probability: Interpreting Categorical and Quantitative Data ★ (S-ID) **Summarize, represent, and interpret data on two categorical and quantitative variables.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.S-ID.B.5. Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data. Connections: *ETHS-S1C2-01*; *ETHS-S6C2-03*; *11-12.RST.9*; *11-12.WHST.1a-1b*; *11-12.WHST.1e*	A I ★	*HS.MP.1.* Make sense of problems and persevere in solving them. *HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.3.* Construct viable arguments and critique the reasoning of others. *HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically. *HS.MP.8.* Look for and express regularity in repeated reasoning.			
HS.S-ID.B.6. Represent data on two quantitative variables on a scatter plot, and describe how the	A I A II ★	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.3.* Construct viable			

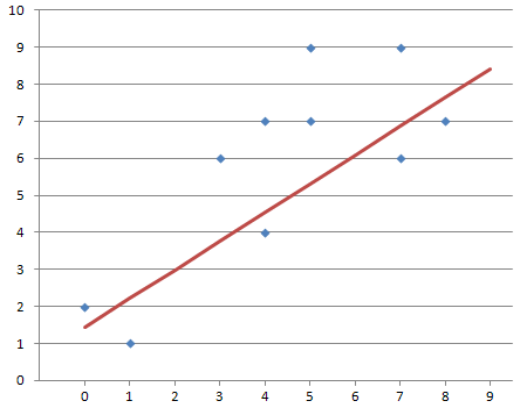
Statistics and Probability: Interpreting Categorical and Quantitative Data ★ (S-ID) **Summarize, represent, and interpret data on two categorical and quantitative variables.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
variables are related. Connections: *SCHS-S1C2-05*; *SCHS-S1C3-01*; *ETHS-S1C2-01*; *ETHS-S1C3-01*; *ETHS-S6C2-03*		arguments and critique the reasoning of others. *HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically. *HS.MP.7.* Look for and make use of structure. *HS.MP.8.* Look for and express regularity in repeated reasoning.			
a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. *Use given functions or chooses a function suggested by the context. Emphasize linear, quadratic, and exponential models.* Connection: *11-12.RST.7*	A I A II ★				
b. Informally assess the fit of a function by plotting and	A I ★				

Statistics and Probability: Interpreting Categorical and Quantitative Data ★ (S-ID) **Summarize, represent, and interpret data on two categorical and quantitative variables.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
analyzing residuals. Connections: *11-12.RST.7*; *11-12.WHST.1b-1c*					
c. Fit a linear function for a scatter plot that suggests a linear association. Connection: *11-12.RST.7*	A I ★				

Statistics and Probability: Interpreting Categorical and Quantitative Data ★(S-ID) **Interpret linear models.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.S-ID.C.7. Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. Connections: *SCHS-S5C2-01*; *ETHS-S1C2-01*;	A I ★	*HS.MP.1.* Make sense of problems and persevere in solving them. *HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.4.* Model with	1.1 1.2 1.3 7.3 7.4 7.5 7.6 7.7 8.1 8.2	To use y=mx+b relationships in functions to extrapolate data	Using the following data, generate a linear model that defines the height of the candle at a given time. Time (min.) | Height (in.) 2 | 10 3 | 8

Statistics and Probability: Interpreting Categorical and Quantitative Data ★(S-ID)

Interpret linear models.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
ETHS-S6C2-03; *9-10.RST.4*; *9-10.RST.7*; *9-10.WHST.2f*		mathematics. *HS.MP.5.* Use appropriate tools strategically. *HS.MP.6.* Attend to precision.	10.1 10.2 11.1 11.2 11.3		<table><tr><td>4</td><td>6</td></tr><tr><td>5</td><td>4</td></tr></table> **Solution:** y=-2x+12
HS.S-ID.C.8. Compute (using technology) and interpret the correlation coefficient of a linear fit. Connections: *ETHS-S1C2-01*; *ETHS-S6C2-03*; *11-12.RST.5*; *11-12.WHST.2e*	A I ★	*HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically. *HS.MP.8.* Look for and express regularity in repeated reasoning.	1.1 1.2 1.3 7.5 10.1 10.2 11.1 11.2 11.3 13.3	To use a correlation coefficient to measure the relationship between an independent variable and its dependent one	The data plotted in blue below has a correlation coefficient of 0.775264. What does the correlation coefficient reveal about the data?  **Solution:** The x-axis values correlate well with the y-axis values.
HS.S-ID.C.9. Distinguish between correlation and	A I ★	*HS.MP.3.* Construct viable arguments and			

Statistics and Probability: Interpreting Categorical and Quantitative Data ★ (S-ID) **Interpret linear models.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
causation. Connection: *9-10.RST.9*		critique the reasoning of others. *HS.MP.4.* Model with mathematics. *HS.MP.6.* Attend to precision.			
Statistics and Probability: Making Inferences and Justifying Conclusions ★ (S-IC) **Understand and evaluate random processes underlying statistical experiments.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.S-IC.A.1. Understand statistics as a process for making inferences to be made about population parameters based on a random sample from that population.	A II ★	*HS.MP.4.* Model with mathematics. *HS.MP.6.* Attend to precision.			
HS.S-IC.A.2. Decide if a specified model is consistent with results from a given data-generating	A II ★	*HS.MP.1.* Make sense of problems and persevere in solving them. *HS.MP.2.* Reason	8.1 8.2 8.3 8.4 8.5	To create a program that will use decimal math and remainder theorems to	A person drew numbers written on small sheets of paper from a container. The number was replaced after it was recorded, and the container was stirred and shaken to redistribute all of the numbers inside. After drawing numbers 1000 times, the person noticed that not all numbers were drawn an equal number of times. What can be concluded from this data?

Statistics and Probability: Making Inferences and Justifying Conclusions ⋆ (S-IC) **Understand and evaluate random processes underlying statistical experiments.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
process, e.g., using simulation. *For example, a model says a spinning coin will fall heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model?* Connections: *ETHS-S6C2-03*; *9-10.WHST.2d*; *9-10.WHST.2f*		abstractly and quantitatively. *HS.MP.3*. Construct viable arguments and critique the reasoning of others. *HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically. *HS.MP.6.* Attend to precision. *HS.MP.7*. Look for and make use of structure. *HS.MP.8.* Look for and express regularity in repeated reasoning.	11.1 10.2	generate random numbers. In addition, students must calculate histograms to measure results.	**Solution:** Nothing can be concluded.

Statistics and Probability: Making Inferences and Justifying Conclusions ★ (S-IC) **Make inferences and justify conclusions from sample surveys, experiments, and observational studies.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.S-IC.B.3. Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each. Connections: *11-12.RST.9*; *11-12.WHST.2b*	A II ★	*HS.MP.3.* Construct viable arguments and critique the reasoning of others. *HS.MP.4.* Model with mathematics. *HS.MP.6.* Attend to precision.			
HS.S-IC.B.4. Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling. Connections: *ETHS-S6C2-03*; *11-12.RST.9*; *11-12.WHST.1e*	A II ★	*HS.MP.1.* Make sense of problems and persevere in solving them. *HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically.			
HS.S-IC.B.5. Use data from a randomized	A II ★	*HS.MP.1.* Make sense of problems and persevere in			

Statistics and Probability: Making Inferences and Justifying Conclusions ★ (S-IC) **Make inferences and justify conclusions from sample surveys, experiments, and observational studies.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
experiment to compare two treatments; use simulations to decide if differences between parameters are significant. Connections:*ETHS-S6C2-03*; *11-12.RST.4*; *11-12.RST.5*; *11-12.WHST.1e*		solving them. *HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically. *HS.MP.8.* Look for and express regularity in repeated reasoning.			
HS.S-IC.B.6. Evaluate reports based on data. Connections: *11-12.RST.*4; *11-12.RST.5*; *11-12.WHST.1b*; *11-12.WHST.1e*	A II ★	*HS.MP.1*. Make sense of problems and persevere in solving them. HS.MP.2. Reason abstractly and quantitatively. *HS.MP.3.* Construct viable arguments and critique the reasoning of others. *HS.MP.4.* Model with mathematics.			

Statistics and Probability: Making Inferences and Justifying Conclusions ★ (S-IC) **Make inferences and justify conclusions from sample surveys, experiments, and observational studies.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
		HS.MP.5. Use appropriate tools strategically. *HS.MP.6.* Attend to precision. *HS.MP.7*. Look for and make use of structure. *HS.MP.8*. Look for and express regularity in repeated reasoning.			

Statistics and Probability: Conditional Probability and the Rules of Probability ★ (S-CP) **Understand independence and conditional probability and use them to interpret data.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***

Statistics and Probability: Conditional Probability and the Rules of Probability ★ (S-CP)

Understand independence and conditional probability and use them to interpret data.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.S-CP.A.1. Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or," "and," "not"). Connection: *11-12.WHST.2e*	A II ★	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.4.* Model with mathematics. *HS.MP.6.* Attend to precision. *HS.MP.7.* Look for and make use of structure.	1.1 1.2 1.3 7.5 10.1 10.2 11.1 11.2 11.3 12.1 12.2 12.3 12.4 12.5	To use Boolean algebra to describe events as unions (OR) and intersections (AND) of other events.	**Question 1** Which colored area represents people who are both programmers and web page designers but not graphic artists? **Solution:** Magenta **Question 2** In deciding which color represents people who are both programmers and web page designers, which method does one use? **Solution:** Intersections 
HS.S-CP.A.2. Understand that two events *A* and *B* are independent if the probability of *A* and *B* occurring together is the product of their probabilities, and use this characterization to determine if they	A II ★	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.4.* Model with mathematics. *HS.MP.6.* Attend to precision. *HS.MP.7.* Look for and make use of			

Statistics and Probability: Conditional Probability and the Rules of Probability ★ (S-CP) **Understand independence and conditional probability and use them to interpret data.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
are independent. Connection: *11-12.WHST.1e*		structure.			
HS.S-CP.A.3. Understand the conditional probability of *A* given *B* as *P*(*A* and *B*)/*P*(*B*), and interpret independence of *A* and *B* as saying that the conditional probability of *A* given *B* is the same as the probability of *A*, and the conditional probability of *B* given *A* is the same as the probability of *B*. Connections: *11-12.RST.5*; *11-12.WHST.1e*	A II ★	*HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.4.* Model with mathematics. *HS.MP.6.* Attend to precision. *HS.MP.7.* Look for and make use of structure.			
HS.S-CP.A.4. Construct and interpret two-way frequency tables of data when two	A II ★	*HS.MP.1.* Make sense of problems and persevere in solving them. *HS.MP.2.* Reason	1.1 1.2 1.3 7.5 10.1	To model two sets of data to determine relationships	**Project** Design and develop a random number generator that will generate frequency tables and determine that the events are independent of each other.

Statistics and Probability: Conditional Probability and the Rules of Probability ★ (S-CP) **Understand independence and conditional probability and use them to interpret data.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. *For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.* Connections: *ETHS-S6C2-03*; *11-12.RST.4*; *11-*		abstractly and quantitatively. *HS.MP.3.* Construct viable arguments and critique the reasoning of others. *HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically. *HS.MP.6.* Attend to precision. *HS.MP.7.* Look for and make use of structure. *HS.MP.8.* Look for and express regularity in repeated reasoning.	10.2 11.1 11.2 11.3 12.1		

Statistics and Probability: Conditional Probability and the Rules of Probability ★ (S-CP) **Understand independence and conditional probability and use them to interpret data.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
12.RST.9; *11-12.WHST.1e*					
HS.S-CP.A.5. Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. *For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.* Connections: *11-12.RST.4*; *11-12.RST.5*;*11-12.WHST.1e*	A II ★	*HS.MP.1.* Make sense of problems and persevere in solving them. *HS.MP.4.* Model with mathematics. *HS.MP.6.* Attend to precision. *HS.MP.8.* Look for and express regularity in repeated reasoning.			

Statistics and Probability: Conditional Probability and the Rules of Probability ★(S-CP) **Use the rules of probability to compute probabilities of compound events in a uniform probability model.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.S-CP.B.6. Find the conditional probability of *A* given *B* as the fraction of *B*'s outcomes that also belong to *A*, and interpret the answer in terms of the model. Connections: *ETHS-S1C2-01*; *ETHS-S6C2-03*; *11-12.RST.9*; *11-12.WHST.1b*; *11-12.WHST.1e*	A II ★	*HS.MP.1.* Make sense of problems and persevere in solving them. *HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically. *HS.MP.7.* Look for and make use of structure.			
HS.S-CP.B.7. Apply the Addition Rule, *P*(*A* or *B*) = *P*(*A*) + *P*(*B*) – *P*(*A* and *B*), and interpret the answer in terms of the model. Connections: *ETHS-S1C2-01*; *ETHS-S6C2-03*; *11-12.RST.9*	A II ★	*HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically. *HS.MP.6.* Attend to precision. *HS.MP.7.* Look for and make use of structure.			
HS.S-CP.B.8. Apply the general Multiplication Rule	+ ★	*HS.MP.4.* Model with			

Statistics and Probability: Conditional Probability and the Rules of Probability ★(S-CP) **Use the rules of probability to compute probabilities of compound events in a uniform probability model.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
in a uniform probability model, $P(A \text{ and } B) = P(A)P(B\|A) = P(B)P(A\|B)$, and interpret the answer in terms of the model. Connections: *ETHS-S1C2-01*; *ETHS-S6C2-03*; *11-12.RST.9*		mathematics. *HS.MP.5.* Use appropriate tools strategically. *HS.MP.6.* Attend to precision. *HS.MP.7.* Look for and make use of structure.			
HS.S-CP.B.9. Use permutations and combinations to compute probabilities of compound events and solve problems. Connections: *ETHS-S1C2-01*; *ETHS-S6C2-03*; *11-12.RST.9*	+ ★	*HS.MP.1.* Make sense of problems and persevere in solving them. *HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.4.* Model with mathematics. *HS.MP.5*. Use appropriate tools strategically. *HS.MP.7.* Look for and make use of structure.			

Statistics and Probability: Using Probability to Make Decisions ★ (S-MD)

Calculate expected values and use them to solve problems.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.S-MD.A.1. Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space; graph the corresponding probability distribution using the same graphical displays as for data distributions. Connections: *ETHS-S6C2-03*; *11-12.RST.5*; *11-12.RST.9*; *11-12.WHST.1b*; *11-12.WHST.1e*	+ ★	*HS.MP.1.* Make sense of problems and persevere in solving them. *HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.3.* Construct viable arguments and critique the reasoning of others. *HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically. *HS.MP.6.* Attend to precision. *HS.MP.7.* Look for and make use of structure. *HS.MP.8.* Look for and express regularity in repeated reasoning.			

Statistics and Probability: Using Probability to Make Decisions ★ (S-MD) **Calculate expected values and use them to solve problems.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.S-MD.A.2. Calculate the expected value of a random variable; interpret it as the mean of the probability distribution. Connections: *ETHS-S1C2-01*; *ETHS-S6C2-03*; *11-12.RST.3*; *11-12.RST.4*; *11-12.RST.9*	+ ★	*HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically. *HS.MP.6.* Attend to precision. *HS.MP.7.* Look for and make use of structure.			
HS.S-MD.A.3. Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value. *For example, find the theoretical probability distribution for the number of correct answers obtained by guessing on all five*	+ ★	*HS.MP.1.* Make sense of problems and persevere in solving them. *HS.MP.3.* Construct viable arguments and critique the reasoning of others. *HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically.			

Statistics and Probability: Using Probability to Make Decisions ★ (S-MD) **Calculate expected values and use them to solve problems.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
questions of a multiple-choice test where each question has four choices, and find the expected grade under various grading schemes. Connections: *ETHS-S1C2-01*; *ETHS-S6C2-03*; *11-12.RST.3*; *11-12.RST.9*; *11-12.WHST.1b*; *11-12.WHST.1e*		*HS.MP.7.* Look for and make use of structure.			
HS.S-MD.A.4. Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value. *For example, find a current data distribution on the number of TV sets per household in the United States, and*	+ ★	*HS.MP.1.* Make sense of problems and persevere in solving them. *HS.MP.3.* Construct viable arguments and critique the reasoning of others. *HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools			

Statistics and Probability: Using Probability to Make Decisions ⋆ (S-MD) **Calculate expected values and use them to solve problems.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
calculate the expected number of sets per household. How many TV sets would you expect to find in 100 randomly selected households? Connections: *ETHS-S1C2-01*; *ETHS-S6C2-03*; *11-12.RST.9*; *11-12.WHST.1b*; *11-12.WHST.1e*		strategically. *HS.MP.7.* Look for and make use of structure.			

Statistics and Probability: Using Probability to Make Decisions ⋆ (S-MD) **Use probability to evaluate outcomes of decisions.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
HS.S-MD.B.5. Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values. Connections: *SSHS-*	+ ★	*HS.MP.1.* Make sense of problems and persevere in solving them. *HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.3.*			

Statistics and Probability: Using Probability to Make Decisions ★ (S-MD) **Use probability to evaluate outcomes of decisions.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
S5C2-03; *SSHS-S5C5-03*; *SSHS-S5C5-05*; *ETHS-S1C2-01; ETHS-S6C2-03*		Construct viable arguments and critique the reasoning of others. *HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically. *HS.MP.6.* Attend to precision. *HS.MP.7.* Look for and make use of structure. *HS.MP.8.* Look for and express regularity in repeated reasoning.			
a. Find the expected payoff for a game of chance. *For example, find the expected winnings from a state lottery ticket or a game at a fast-food restaurant.* Connections: 11-12.RST.3; *11-12.RST.9*; *11-12.WHST.1b*; *11-12.WHST.1e*	+ ★				
b. Evaluate and compare strategies on the basis of expected values. *For example, compare a high-deductible versus a low-deductible automobile insurance policy*	+ ★				

Statistics and Probability: Using Probability to Make Decisions ★ (S-MD) **Use probability to evaluate outcomes of decisions.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
using various, but reasonable, chances of having a minor or a major accident. Connections: *11-12.RST.3*; *11-12.RST.9*; *11-12.WHST.1b*; *11-12.WHST.1e*					
HS.S-MD.B.6. Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator). Connections: *ETHS-S1C2-01*; *ETHS-S6C2-03*; *11-12.RST.3*; *11-12.RST.9*; *11-12.WHST.1b*; *11-12.WHST.1e*	+ ★	*HS.MP.1.* Make sense of problems and persevere in solving them. *HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.3.* Construct viable arguments and critique the reasoning of others. *HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically.	1.1 1.2 1.3 7.5 10.1 10.2 11.1 11.2 11.3	To use integer math and truncation of decimals to generate random numbers	**Project** Design and develop software that will allow teachers to enter in student names. When the button is pressed, the software will randomly choose a student to answer the question. The software will make sure that all students are called upon and will not call the same student twice before all other students have been selected.

Statistics and Probability: Using Probability to Make Decisions ★ (S-MD) **Use probability to evaluate outcomes of decisions.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
		HS.MP.7. Look for and make use of structure.			
HS.S-MD.B.7. Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game). Connections: *ETHS-S1C2-01*; *ETHS-S6C2-03*	+ ★	*HS.MP.1.* Make sense of problems and persevere in solving them. *HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.3.* Construct viable arguments and critique the reasoning of others. *HS.MP.4*. Model with mathematics. *HS.MP.5*. Use appropriate tools strategically. *HS.MP.7.* Look for and make use of structure.			

Contemporary Mathematics: Discrete Mathematics ★ (CM-DM)

Understand and apply vertex-edge graph topics.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
AZ.HS.CM-DM.A.1. Study the following topics related to vertex-edge graphs: Euler circuits, Hamilton circuits, the Travelling Salesperson Problem (TSP), minimum weight spanning trees, shortest paths, vertex coloring, and adjacency matrices. Connections: *ETHS-S6C2-03*; *11-12.RST.4*; *11-12.RST.5*; *11-12.RST.9*; *11-12.WHST.1b*; *11-12.WHST.1e*	+ ★	*HS.MP.1.* Make sense of problems and persevere in solving them. *HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.3.* Construct viable arguments and critique the reasoning of others. *HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically. *HS.MP.6.* Attend to precision. *HS.MP.7.* Look for and make use of structure. *HS.MP.8.* Look for and express regularity in repeated reasoning.	1.1 1.2 1.3 7.5 9.2 9.3 10.1 10.2 11.1 11.2 11.3 12.1 12.2 12.3 13.1 13.2	To use computer software in solving discrete mathematics problems such as Spanning Tree problems	**Project** Implement a Java program to generate a Eulurian Trail from one vertex to another one using the following computer algorithm: 1. Make sure the graph is connected and all vertices have an even degree. 2. Start at any vertex. 3. Travel through an edge if a. it is not a bridge for the untraveled part, or b. there is no other alternative. 4. Label the edges in the order which they were traveled Leave no untraveled edges.

Contemporary Mathematics: Discrete Mathematics ★ (CM-DM)

Understand and apply vertex-edge graph topics.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
AZ.HS.CM-DM.A.2. Understand, analyze, and apply vertex-edge graphs to model and solve problems related to paths, circuits, networks, and relationships among a finite number of elements, in real-world and abstract settings. Connections: *ETHS-S6C2-03*; *11-12.RST.9*; *11-12.WHST.1b*; *11-12.WHST.1e*;	+ ★	*HS.MP.1.* Make sense of problems and persevere in solving them. *HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.3.* Construct viable arguments and critique the reasoning of others. *HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically. *HS.MP.6.* Attend to precision. *HS.MP.7.* Look for and make use of structure. *HS.MP.8.* Look for and express regularity in repeated	1.1 1.2 1.3 7.5 9.1 9.2 9.3 9.4 10.1 10.2 11.1 11.2 11.3	To create algorithms to solve for the shortest path through a graph	**Project** Implement Dijkstra's Shortest Path algorithm in Java to find the shortest distance from the source to each vertex in the graph. Utilize a map data structure to store a list of shortest distances from the source node to all other nodes.

Contemporary Mathematics: Discrete Mathematics ★ (CM-DM) **Understand and apply vertex-edge graph topics.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
		reasoning.			
AZ.HS.CM-DM.A.3. Devise, analyze, and apply algorithms for solving vertex-edge graph problems. Connections: *ETHS-S6C2-03*; *11-12.RST.3*; *11-12.RST.4*; *11-12.RST.9*; *11-12.WHST.1a*; *11-12.WHST.1b*; *11-12.WHST.1e*	+ ★	*HS.MP.1.* Make sense of problems and persevere in solving them. *HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.3.* Construct viable arguments and critique the reasoning of others. *HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically. *HS.MP.6.* Attend to precision. *HS.MP.7.* Look for and make use of structure. *HS.MP.8.* Look for and express regularity in			

Contemporary Mathematics: Discrete Mathematics ★ (CM-DM)

Understand and apply vertex-edge graph topics.

Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
		repeated reasoning			
AZ.HS.CM-DM.A.4. Extend work with adjacency matrices for graphs, such as interpreting row sums and using the nth power of the adjacency matrix to count paths of length *n* in a graph. Connections: *ETHS-S6C2-03*; *11-12.RST.4*; *11-12.RST.5*; *11-12.RST.9*; *11-12.WHST.1a*; *11-12.WHST.1b*; *11-12.WHST.1e*	+ ★	*HS.MP.1*. Make sense of problems and persevere in solving them. *HS.MP.2.* Reason abstractly and quantitatively. *HS.MP.3.* Construct viable arguments and critique the reasoning of others. *HS.MP.4.* Model with mathematics. *HS.MP.5.* Use appropriate tools strategically. *HS.MP.6.* Attend to precision. *HS.MP.7*. Look for and make use of structure. *HS.MP.8.* Look for and express			

Contemporary Mathematics: Discrete Mathematics ★ (CM-DM) **Understand and apply vertex-edge graph topics.**					
Standards *Students are expected to:*	***TRAD***	***Mathematical Practices***	***CTE Standard / Measurement Criterion***	***Application of Mathematics Standard***	***Explanations and Examples***
		regularity in repeated reasoning.			